ORGANIZATION: PEERLESS-WINSMITH, INC.
WARREN, OHIO

REPORT NO.: 99901080/87-01	INSPECTION DATE: 1/12-14/87	INSPECTION ON-SITE HOURS: 20

CORRESPONDENCE ADDRESS: Peerless-Winsmith, Inc.
ATTN: Mr. Steven Pop
General Manager
1401 West Market Street
Warren, Ohio 44485

ORGANIZATIONAL CONTACT: David O'Mahen
TELEPHONE NUMBER: (216) 399-3651

NUCLEAR INDUSTRY ACTIVITY: AC and DC motors used in various types of motor operated valve actuators.

ASSIGNED INSPECTOR: James T. Conway for 2-27-87
Jeffrey J. Jacobson, Reactive Inspection Section (RIS) Date

APPROVED BY: James T. Conway for 2-27-87
Edward T. Baker, Acting Chief, RIS, Vendor Program Branch Date

INSPECTION BASES AND SCOPE:

A. BASES: 10 CFR Part 21.

B. SCOPE: This inspection was made as a result of various reported failures of Peerless motors installed in Limitorque motor operated valve actuators and as a result of a recent NRC inspection performed at Limitorque where it was learned that a number of manufacturing changes had been made to previously qualified Peerless motors.

PLANT SITE APPLICABILITY: All plant sites using Limitorque DC motor operated valve actuators.

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A. VIOLATIONS:

1. Contrary to Section 21.21 of 10 CFR Part 21 Peerless-Winsmith (P-W) did not adopt a procedure to evaluate or report defects discovered in motors supplied to their customers under 10 CFR Part 21 requirements. (87-01-01)

2. Contrary to Section 21.6 of 10 CFR Part 21, P-W did not post Part 21, Section 206 of the Energy Reorganization Act of 1974, or a related internal procedure in their engineering or manufacturing areas within the plant. (87-01-02)

B. NONCONFORMANCES:

None.

C. UNRESOLVED ITEMS:

None.

D. STATUS OF PREVIOUS INSPECTION FINDINGS:

None.

E. OTHER FINDINGS AND COMMENTS:

1. Conformance to Purchase Order Requirements

The inspector reviewed purchase orders (PO) to P-W from three of their customers. PO #P53253 dated 8/22/86 from Borg Warner Industrial Products was written for two 575 VAC motors. The PO invoked various quality assurance (QA) and procedural requirements. PO #30090 dated 10/10/86 from Paul-Murroe for one 460 volt three phase motor was also reviewed. This PO contained only technical specifications, but it did invoke 10 CFR Part 21.

The vast majority of nuclear motors manufactured at P-W are DC motors supplied to Limitorque Corporation. Limitorque PO 22044 dated 12/8/86 for one, 125 volt DC motor was reviewed to determine what QA requirements were imposed on P-W. The PO stated the motor was to be supplied in accordance with Limitorque EQC-1 Rev. H and Limitorque Standard 21-497-0014-1 Rev. D. EQC-1 is a Limitorque electrical quality control document which contains performance data for AC and DC motors. The DC motors in question are 20% run, five minute duty and are

designed to Limitorque speed-torque curve EQC-8. Standard 21-497-0014-1 contains specific manufacturing requirements for DC motors and invokes 10 CFR Part 21 and the P-W Quality Control Program dated 4/14/82. Material configuration controls and a QA program were added in a recent change to Limitorque Standard 21-497-0014-1 after configuration control problems surfaced with P-W motors supplied to Limitorque. The P-W QA program is not intended to meet the requirements of Appendix B 10 CFR Part 50, but it appears to be adequate to obtain the necessary degree of control at this facility. Implementation of specific areas of the P-W QA program was reviewed by the inspector. It was determined that all nuclear motors manufactured at P-W are tested to design specifications, and the data is reviewed by engineering for acceptance. A review of the P-W instrument calibration program determined that an adequate calibration program is in place and selected instruments were within calibration requirements.

2. Part 21 Program

During the inspection it was determined that P-W did not have a 10 CFR Part 21 program in place, and copies of Part 21 and Section 206 of the Energy Reorganization Act of 1974 were not posted as required. (See Violations 87-01-01 and 87-01-02)

3. Manufacturing Changes to Qualified Motors

Many nuclear motors supplied by P-W to Limitorque are subsequently used in environmentally qualified installations at various nuclear power plant sites. In most cases qualification of the motor operators is based upon Limitorque's qualification test report B0009 dated 4/30/76 and an assurance that subsequently purchased motor operators contain materials which are identical to the ones previously tested. During a recent inspection at Limitorque, it was determined that significant changes had been made to motors supplied by P-W, and they were installed in environmentally qualified motor operators since the Limitorque test. Specifically, changes were made to motor magnet wire, insulating varnish, and motor lead wires.

During the inspection at P-W it was determined that the motor tested in Limitorque test report B0009 contained either PTX or GP-200 wire for the field and GP-200 or ML magnet wire for the armature. Subsequent to 1978 only ML magnet wire has been used for motor armatures. The tested motor was also determined to be manufactured using P.D. George #923 epoxy varnish. After November 1985, P-W changed to Sterling U-475 type varnish. The inspector

was given specifications for both varnish types however no formal analysis has been performed as to the suitability of using either the sterling varnish or the various magnet wires in environmentally qualified motors.

4. Lead Wire Changes and Subsequent Failures

P-W has supplied nuclear motors to Limitorque with three different types (materials) of motor leads. Until November 1984 motors were fitted with lead wires consisting of nomex insulation with a glass epoxy braided overcoat. The insulation consisted of nine wraps of .003" nomex (for a total of .027" nomex) plus a glass epoxy braided overcoat. This was the type of motor lead insulation on the motor tested and reported in Limitorque report B-0009. Between November 1984 and December 1985 P-W used motor leads wrapped with 50% overlapped .003" nomex with a 50% overlapped layer of .0012" F616 Kapton/FEP. Total insulation thickness for this wire is calculated to be .0045" nomex plus .002" Kapton/FEP. This insulation system is therefore six times thinner than that used on the qualified motors. Although this change was reported to and approved by Limitorque, a formal analysis as to its effect on environmental qualification was never made.

Consequently, the NRC has learned of two significant failures directly attributable to the use of the nomex-Kapton leads. On May 6, 1986 Portland General Electric reported to the NRC the failure of a Limitorque motor operator for an auxiliary feedwater flow control valve at the Trojan facility. The failure was determined to be attributable to motor leads within the operator whose insulation had become degraded and which had shorted out. A subsequent inspection at Trojan revealed that three other similar motors had leads which had experienced similar degradation. Recently the NRC learned of another failure at the Turkey Point facility also involving the nomex-Kapton leads. It has been determined that motors fitted with nomex-Kapton leads have been supplied to thirty (30) nuclear power plants and Limitorque has suggested installing a sleeving system over the leads as soon as qualification testing of the system can be completed. IE Information Notice 87-08 has been issued alerting licensees of this potential problem.

After December 1985 Peerless switched back to a lead wire similar to that originally used, consisting of three layers of .003" nomex applied with a 50% overlap plus a glass epoxy braided overcoat. Damage to motor leads of this type has also been

observed on replacement motors shipped to Trojan Nuclear Power Plant and on motors returned to Peerless from Limitorque. It is believed that the leads may have been damaged during shipping, during motor installation at Limitorque, or at the nuclear plant site. Peerless is now installing protective sleeving over the motor leads to prevent any further shipping damage.

5. Motor Burnouts

During the inspection it was determined that in the last two years fifteen Peerless nuclear motors installed in Limitorque motor operators were returned to Peerless in a burnt out condition. The burnouts occurred at a variety of nuclear power plants and appear to be due to overheating. In discussions with Peerless it was determined the overheating is most likely being caused by excessive torque loads being imposed on the motor. The DC motors supplied to Limitorque are 20%, 5 minute duty motors designed to operate at 20% of their rated torque output. Should torque loads on the motor greatly exceed 20%, motor overloading and burnout could occur in a short period of time. The motors are tested at Peerless to ensure proper speed at 20% and no load torque conditions however no tests are done at higher torque loads.

The inspector observed two motors returned from the Brunswick nuclear power station (S/Ns NK39956 and PK 40902). Both motors appeared to have been severely overheated and had experienced extensive damage as a result.

F. EXIT MEETING

An exit meeting was held following completion of the inspection. The inspectors findings and violations were discussed along with commitments made by Peerless to look into the cause of the rash of recent motor failures. The following were present at the exit meeting:

J. D. O'Mahen, Chief Engineer-Motors
J. Richardson, Service Manager
S. Pop, General Manager
A. Ritchie, Plant Superintendent/Quality Control